

Biomedical Monitoring by a Novel Noncontact Radio Frequency Technology (RFII)

Completed Technology Project (2012 - 2014)



Project Introduction

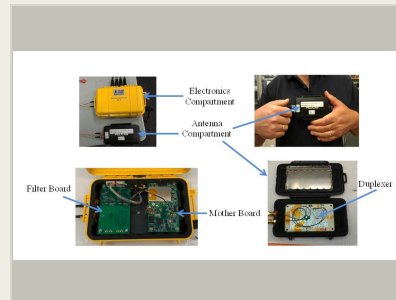
The area of Space Health and Medicine is one of the NASA's Space Technology Grand Challenges. Space is an extreme environment which is not conducive to human life. The extraterrestrial environment can result in the deconditioning of various human physiological systems and thus require easy to use physiological monitoring technologies in order to better monitor space crews for appropriate health management and successful space missions and space operations. Furthermore, the Space Technology Roadmap's Technology Area Breakdown Structure calls for improvements in research to support human health and performance (Technology Area 06). To address these needs, this project investigated a potential noncontact and noninvasive radio frequency-based technique of monitoring central hemodynamic function in human research subjects in response to orthostatic stress.

This technology will be a quantum advance in cardiac monitoring and will be applicable in numerous situations such as for immediate assessment and monitoring of patients in life-threatening emergencies, during environmental stressors, and in performance of hazardous occupational tasks. Because the RFII data can be monitored from a central location, multiple devices could be used to monitor several patients simultaneously, such as in a car accident with multiple injured victims. For NASA these benefits will apply to both flight and ground personnel. For the military this device can be used during actual combat to alert medical personnel when a service member is wounded and to monitor his/her condition even before help is provided thus lowering medical evaluation times. This can also be used to aid medical personnel allowing them to prioritize triage and evacuation in multiple casualty contingencies. The goal for this project is to design, develop and advance technology for a near-instantaneous, non-invasive radio frequency-based method for measuring heart and lung function without invasive probes, cuffs, electrodes and without patient contact.

Anticipated Benefits

One benefit of this technology is that the Radio Frequency Impedance Interrogation (RFII) technology, which provides information about a patient's cardiac performance using low-power radio frequency, is compact and portable and has the potential to provide advanced telemedicine capabilities not only for NASA, but for doctors and patients on Earth.

Aboard the International Space Station, noncontact monitoring of heart rate, cardiac output and respiration is needed. At Kennedy Space Center, monitoring is also needed in stressful tasks, i.e. firefighting and Self-Contained Atmospheric Protection Ensemble (SCAPE) suits activities.



The Prototype Radiofrequency Unit Hardware

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

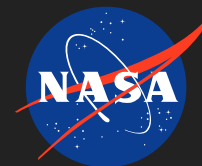
Kennedy Space Center (KSC)

Responsible Program:

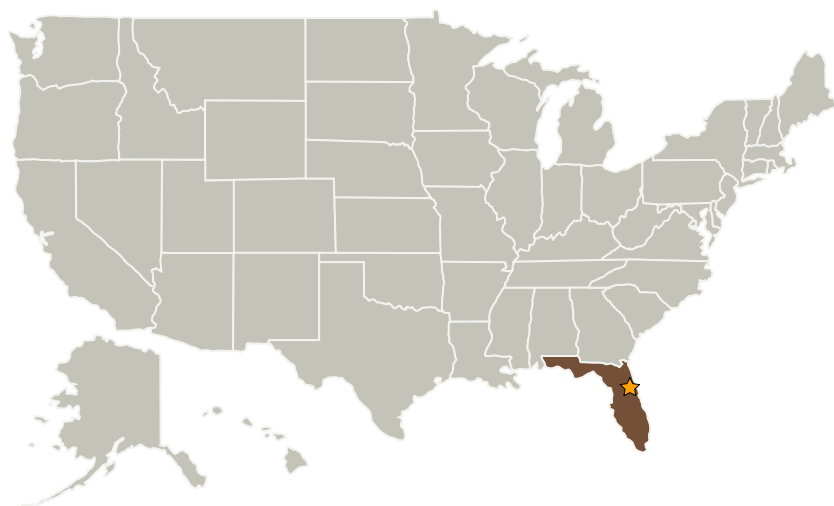
Center Innovation Fund: KSC CIF

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Primary U.S. Work Locations and Key Partners



Project Management

Program Director:

Michael R Lapointe

Program Manager:

Barbara L Brown

Project Managers:

David A Tipton

David R Bush

Principal Investigator:

David A Tipton

Co-Investigators:

Robert Friedman

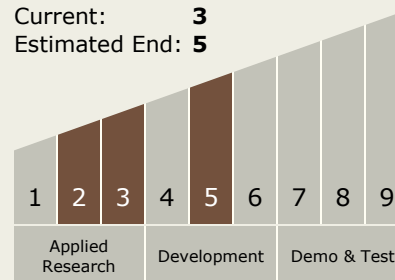
Kenneth D Cohen

Technology Maturity (TRL)

Start: 2

Current: 3

Estimated End: 5



Technology Areas

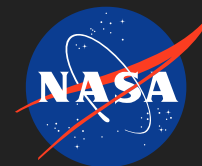
Primary:

- TX06 Human Health, Life Support, and Habitation Systems
 - TX06.3 Human Health and Performance

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Organizations Performing Work	Role	Type	Location
★ Kennedy Space Center(KSC)	Lead Organization	NASA Center	Kennedy Space Center, Florida
Department of Defense(DoD)	Supporting Organization	US Government	Washington, District of Columbia
Department of the Navy(USN)	Supporting Organization	US Government	Washington, District of Columbia
InoMedic Health Applications, Inc.	Supporting Organization	Industry Small Disadvantaged Business (SDB), Veteran-Owned Small Business (VOSB)	
Noninvasive Medical Technologies, Inc.(NMT)	Supporting Organization	Industry	

Technology Areas (cont.)

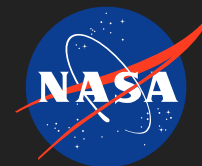
- TX06.3.4 Contact-less / Wearable Human Health and Performance Monitoring

Primary U.S. Work Locations

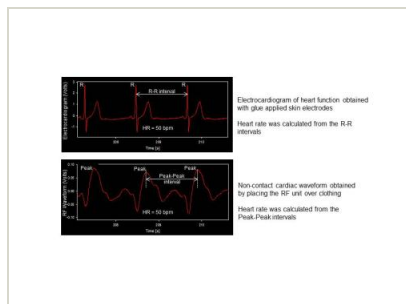
Florida

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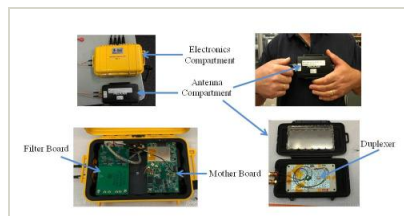
Images



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Biomedical Monitoring by a Novel Noncontact Radio Frequency Technology

(<https://techport.nasa.gov/image/2126>)



RFII Hardware

The Prototype Radiofrequency Unit Hardware

(<https://techport.nasa.gov/image/2662>)